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Treatment of "Brewers' Waste," &c.

LETTERS PATENT to Alfred Gordon Salamon, of Clapham Park, in the County of Surrey, Associate of the Royal School of Mines, and Fellow of the Chemical Society, for an Invention of "Improvements in the Treatment of 'Brewers' Waste,' and in the Utilization of the Products Derived therefrom."

PROVISIONAL SPECIFICATION left by the said Alfred Gordon Salamon at the Office of the Commissioners of Patents on the 27th September 1881.

Alfred Gordon Salamon, of Clapham Park, in the County of Surrey, Associate of the Royal School of Mines, and Fellow of the Chemical Society. "Improvements in the Treatment of 'Brewers' Waste,' and in the Utilization of the Products Derived therefrom."

The object of this Invention is so to treat the "bottoms" of barrels of beer known as "brewers waste," as to render the same available in great part for blending, while a valuable bye product is obtained suitable for various uses. The brewers waste or settlings in the barrels thrown down by the isinglass finings used by the publicans to brighten the beer amounts on an average to about 5 per cent. of the brewers output, and it is therefore a matter of considerable moment to utilize this substance. At present it is treated in the following manner:—

The brewers waste is pumped into large subsidence vats, and after being left there for some months, a large percentage of the solid matter is deposited. Owing however to the opaque and glutinous nature of the fluid it cannot be used as a mixing beer, but is "freshed" with an acid and used for "cutting finings," its value being little more than one twelfth ($^1/_{12}$) of the original value of the beer, while the bye product has little or no commercial value.

According to my Invention I precipitate the gelatinous matter of the brewers waste by a solution of persulphate of iron, or other suitable salt of iron combined with such alkaline neutralizing agents as shall render the solution only sufficiently acid to prevent precipitation of the iron salts. If the waste is required for

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"cutting finings" I use an acid solution of the persulphate in order the more effectively to dissolve the isinglass. The waste having been thus manipulated with the persulphate solution is to be passed through an efficient filtering apparatus in order to separate the bright clear beer from the solid matter with which it is mixed.

The proportion of persulphate which I employ will depend upon the amount of gelatinous matter in the waste, and should be the proper chemical equivalent for the gelatinous matter to be thrown down; as too little will not effect the complete precipitation, and too much will be injurious to the beer.

By subjecting the waste thus treated to the action of a filter press under a pressure of some 200 lbs. per square inch, the gelatinous matter will be extracted and compressed into a cake, and the liquid portion will be run off as bright beer. The gelatinous cake will contain all the solid impurities in the waste. This cake is easily detachable from the surface of the cloth in the filtering press, and may be profitably used in connection with the manufacture of papier-maché or cognate purposes, or in the manufacture of cattle food.

SPECIFICATION in pursuance of the conditions of the Letters Patent filed by the said Alfred Gordon Salamon in the Great Seal Patent Office on the 22nd March 1882.

ALFRED GORDON SALAMON, of Clapham Park, in the County of Surrey, Associate of the Royal School of Mines, and Fellow of the Chemical Society. "IMPROVEMENTS IN THE TREATMENT OF BREWERS' WASTE, AND IN THE UTILIZATION OF THE PRODUCTS DERIVED THEREFROM."

This Invention relates to improvements in the treatment of "brewers waste," the object being to separate therefrom the gelatinous matter which it contains, and to utilize both it and the resulting clear liquid. The Invention relates mainly to the treatment of the waste obtained from porter and ale barrels; but it also applies to the treatment of the waste or grounds obtained from cider and perry vats.

In order to define more clearly the nature of this Invention, I proceed to give a description of the method by which such substances as "brewers waste" are produced, together with a description of the substance, and the present method of dealing with the same by ale and porter brewers, according to the present system of London brewing, a system which is also in use in many large country breweries.

The object of the brewer is to produce a bright clear potable beer in as short a time as possible, that is to say, that the enormous dimensions of the trade will not allow of his keeping his beers a sufficiently long time in store to permit of any suspended solid matter which may be present falling by gradual subsidence to the bottom of the cask. It is necessary to use some ingredient which shall effect a rapid clearance of the beer, so that it may be used almost immediately after delivery at the public house.

In these circumstances the brewer has been led to adopt what is known as the method of "fining." This may be described as follows:—The brewer delivers to the publican generally with each consignment of beer a small cask of isinglass which has been dissolved in "pricked" or sour beer, or in beer rendered sour by the addition of acid, generally acetic or sulphurous acid. This isinglass solution is in the state of a clear mucilage, precautions being taken by the careful brewer to prevent any solid isinglass being present in it. The publican before retailing from the casks delivered by the brewer adds a small quantity of this solution to the beer in each cask. The precise action of this isinglass solution upon the beer is not definitely known, and the question is still *sub judice*, as to whether its action is purely physical or of a chemico-physical nature; but it is generally held that it spreads over the surface of the beer in the cask like a web or menstruum, which gradually falls in virtue of its weight, carrying with it all the solid suspended matter in the beer. In any case the effect is to produce a rapid clearance of the beer, and render it fit for immediate use. The draw back connected with its use consists in the fact that a considerable portion of the beer in the cask is unfit for use owing to the presence of the isinglass mucilage containing the suspended matter. This is collected by the publican and returned in casks by him to the brewer, the latter allowing for it, or supplying in place thereof good beer. It will thus be seen that the brewer has a great quantity of this substance upon his hands. It is variously known as "waste," "bottoms," "grounds," or "returns," but I wish it to be understood that by the term "brewers waste" I mean the substance thus returned by the publican, or a substance often produced in the brewery itself by similar or analogous treatment with isinglass, sole skins, or similar gelatinous materials. The term "grounds" as likewise the term "bottoms" is generally applied to the thickest portions of such deposits. The terms "returns" is also sometimes applied to sour beer returned by the publican to the brewer simply because it has turned sour. To this latter substance my Invention is not applicable, unless it has been fined with a gelatinous solution.

The amount of such waste, as shewn by the brewer's books, may be taken to average about five per cent. of the annual output of each brewery, such an amount of course varying with the composition of the water, the substances introduced, and the nature and methods used in the brewing operations.

At present it is generally disposed of as follows:—It is pumped into large subsidence vats and allowed to remain in a state of quiescence for a term varying at different breweries from several days to several months. In this manner the suspended gelatinous matter gradually subsides, carrying with it a large proportion of the impure matter previously recovered from the beer. The upper portion of the beer gradually becomes brighter, but it can never be blended with "running" ales with safety, and moreover it is only a small percentage of the total quantity of beer in the "waste" that is recovered. This is again used in the preparation of "finings," and the remaining thick portion in the vat or "back" is generally run away down the drain. Thus the process of "fining," though a necessary adjunct to the method of brewing in use in the principal breweries at present (exclusive of the Burton breweries) in England, is at the same time a very wasteful one, and entails a large annual loss upon the brewer.

By the adoption of my Invention which I now proceed to describe this loss may be entirely obviated, and in addition, time now necessary for subsidence and space occupied by subsidence vats or backs may be saved.

After repeated experiments I have found that "brewers waste" cannot be effectually purged of its gelatinous constituents by purely mechanical means, that is to say, it cannot be filtered through any ordinary form of filtering medium because the latter becomes coated with a thin layer of slimy nature which effectually stops further filtration. If pressure be applied so as to force the liquid through the pores of the filtering medium it is found equally unsatisfactory, indeed the slimy material is only forced further into the pores of the filtering medium by such means. Hence I have been led to the conclusion that the most effective method of economically dealing with the waste is to precipitate the gelatinous slimy matter contained therein, in such a manner as to convert it into a coherent precipitate. It is important that by the addition of such a precipitating material or re-agent nothing shall be introduced calculated to injure the taste, quality, or properties of the beer contained in the waste. Given the gelatinous matter precipitated in this form, that is, in the form of a flocculent or granular precipitate, which by filtration and pressure can be made to co-here, and the formation of which does not injure the beer; it may then by combined filtration and pressure be separated from the clear bright beer, and practically the whole of the latter contained in the waste may be recovered.

After experimenting with a vast number of substances, I have found that those which best fulfil the conditions above set forth are the per-salts of iron. From the use of the persulphate of iron, the perchloride of iron, and the pernitrate of iron, I have obtained good results, but I preferably use the persulphate of iron, and that in a soluble form, the most convenient being that usually known as the "liquor ferri persulph" of commerce. I prefer to use the persulphate, because if experiment should develop the fact that the beer contained free acid, and above all free sulphuric acid present, perchance in the iron solution or produced after precipitation of the gelatinous compound, then the acid may be at once rendered inert by the addition of a lime compound, such as calcic hydrate, before the mixture of beer and precipitated gelatinous matter is submitted to filtration and pressure. The lime or neutralizing compound may if desired be conveniently added to the waste before the iron solution is added to the latter. I prefer also to use a persulphate of iron solution, which is combined with such alkaline neutralizing agents (of a harmless nature, such as caustic soda) as shall render the solution only sufficiently acid to prevent precipitation of the iron salts. If the persulphate of iron is used it should be free from proto salts, and should preferably be in a very concentrated form so as to minimise the quantity of fluid which need be added to the "waste." The iron salt may be added, mixed with any compound tending to improve the quality of the beer or fluid to which it is added. This remark more especially applies to admixture with lime compounds, with antacids, or with any compound tending to arrest secondary fermentation of the beer or fluid. The per-salts, if iron, may be added in a mixed form if desired. Thus I have found that cider or perry grounds may be conveniently treated by a solution containing the persulphate of iron and the perchloride of iron in equal parts. If this is done the subsequent or prior addition of a lime compound to the grounds is desirable. The presence of free sulphuric acid may of course be ascertained by experiment in the usual manner with baric chloride, &c.

If the beer from the waste is required for "cutting finings" I should preferably use an acid solution of the iron salt so as to effect the more speedy dissolving of the isinglass.

The amount of iron solution which must be added to the "waste" will of course vary with the amount of foreign gelatinous matter present in the particular sample, but this may easily be ascertained by a simple experiment. It is advisable before adding the re-agent to a large bulk of the "waste" to experiment upon a small sample of it. To this end I take a quart of an average sample of the waste, and drop a few drops of the precipitating fluid from a pipette into it to test it qualitatively, then stir well and leave it for about two minutes. If sufficient has been added the gelatinous matter will be at once precipitated as a rapidly subsiding flocculent precipitate. This re-action should take place in the cold. Throw some of the waste which has been thus treated upon a filter, and test the filtrate for free sulphuric acid. If this is present it will only be in very small quantity; lime compounds may be added with advantage to the waste. Having thus satisfied myself that a precipitate without preparatory treatment may be obtained, I next, in order to ascertain the requisite proportion of the re-agent, introduce some of the re-agent with a graduated tube or Burette, and by experimenting upon a given quantity of waste I ascertain the amount of re-agent required for the precipitation of the gelatinous matter present in a barrel of "waste."

The best practical test for ascertaining when sufficient quantity of the re-agent has been added is to filter a sample after it has been properly precipitated, and taste it. I find that that the slightest excess of iron salt in the beer, cider, or perry, can be detected in this manner. Another good indication is to be found in the dichroic appearance of the filtered beer. If the eye is placed at right angles to the vessel containing the beer the latter will appear of the ordinary colour; but if it be looked at from below upwards it will be seen to assume a greenish tinge towards the top of the beer. This is a sure indication of an excess of the iron salt. It is likewise indicated by the greenish appearance of the precipitate, which should, if excess of iron has not been added, be of a dirty yellow-brown colour.

The correct quantity of the precipitating fluid having thus been found, it should be added to the bulk of the waste. I find that a very convenient way of adding it, and one which ensures a thorough admixture with the waste, is by a rose, similar to that commonly used with an ordinary garden watering can. During the gradual addition of the re-agent the mass should be well "roused" or stirred, and this should be continued for some few minutes afterwards. The mixture is then ready for introducing into any convenient filtering apparatus or press for the purpose of separating the precipitate from the beer, which latter should, after filtration, be pure, good, and bright. This is best accomplished by means of a pump.

I may add that the average quantity of the re-agent which in my various experiments on a large scale I have found it advisable to add is about half a pint of the re-agent per barrel of waste. The residue in the press or filtering apparatus should consist of a thick mud. This may be subsequently diluted with "liquor" to a certain extent, and may be sold to the yeast manufacturer. It is also useful for pig feeding, and for the manufacture of such materials as papier-maché, or for the extraction of the gelatine with a view to its conversion into size for other uses.

The iron salts should be kept excluded from the air. The solutions of iron salts are extremely cheap, and the whole process may be conducted at a small cost.

The chief advantages gained by the adoption of my process above described are the following:—

1. What was formerly a waste product of but slight value is by my process converted into valuable blendable beer, which if only used for finings should effect a large annual saving to the brewer.

2. The residuum consisting of the gelatinous matter which was of no value I now utilize by reducing it to a semi-solid form, and thus render it suitable for use by the yeast manufacturer, or for use in the manufacture of cattle food, or in papier-maché and kindred manufactures.

Having now set forth the nature of my Invention of "Improvements in the Treatment of 'Brewers Waste,' and in the Utilization of the Products Derived therefrom," and explained the manner of carrying the same into effect, I wish it to be understood that under the above in part recited Letters Patent I claim,—

Treating the waste known as "bottoms," "grounds," and "returns," in the manner above described, whereby the gelatinous matter contained therein is recovered in a solid or semi-solid form, and the fluid portion in a bright state suitable for the special purposes above set forth.

In witness whereof, I, the said Alfred Gordon Salamon, have hereunto set my hand and seal, the Twenty second day of March, in the year of our Lord One thousand eight hundred and eighty two.

ALFRED GORDON SALAMON. (L.S.)

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